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Interface Technical Specification of the V.25 bis Emulator.

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ABSTRACT (ONGERUBRICEERD)

This document contains the interface technical specification for the V.25 bis Emulator developed by TNO-FEL under the contract number A93KL626, in support of the RNLA's VLOTATS project. The V.25 bis Emulator is capable of emulating a subset of the CCITT Recommendation V.25 bis interface protocols in both DTE and DCE mode of operation. The Emulator will be used during the conformance testing of the following equipments to be employed in the VLOTATS project:

- i) - Communications Gateway.
- ii) - Message Terminal Communicatie Kaart.
- iii) - Digitaal Beveiligd Telefoontoestel.
- iv) - Data Communication Card.

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SUMMARY

This chapter contains a summary of the major technical aspects of the V. 25 bis Emulator.

The V.25 bis Emulator has been developed in support of the DMKL VLOTATS project as an evaluation tool for use during the conformance testing of the four following equipments:

- i) - Communications Gateway.
- ii) - Message Terminal Communicatie Kaart.
- iii) - Digitaal Beveiligd Telefoontoestel.
- iv) - Data Communication Card.

The V.25 bis Emulator supports a subset of the Command and Indication procedures defined in the remote dialling specification contained in the CCITT Recommendation V.25 bis (Blue Book, 1988). Based on this recommendation, the V.25 bis Emulator is capable of emulating both the "Call set-up" and "Answering of an Incoming Call" interface procedures in the DTE as well as in the DCE mode of operation. The V.25 bis Emulator emulates only the signalling aspects of the CCITT Recommendation V.25 bis, it does not provide for the control and transfer of data beyond this signalling phase, that is after the call has been established and during the traffic phase. With respect to the network interface, the V.25 bis Emulator primarily emulates the network characteristics of the ZODIAC network (i.e. time delays etc), however this is achieved in software, and therefore no actual physical coupling to the network is provided.

The V.25 bis Emulator is housed in a IBM compatible LAPTOP personal computer. Operation of the V.25 bis Emulator is achieved via a hierarchical "Menu Driven Display", from which a operator is able to select the particular CCITT Recommendation V.25 bis functionality required. Via this man-machine interface the operator can manually, step by step, as well as automatically, "real-time", perform a number of different test scenarios during the Call set-up and Incoming call interface procedures.

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1 INTRODUCTION

Within the Royal Netherlands Army (RNLA) project called "Verlenging Life of Type Automatisch Telegrafie Systeem (VLOTATS)" mobile message handling facility, equipment is being developed or modified which will be responsible for the end-to-end communication over, as well as the interface coupling to, the RNLA ZODIAC network, which provides both dial-up and/or semi-permanent connections. This equipment is classified (as in the CCITT recommendations):

Data Terminal Equipment (DTE)

- i) - Communications Gateway (CGW)
- ii) - Message Terminal Communicatie Kaart (MTCK)

Data Circuit-Terminating Equipment (DCE)

- iii) - Digitaal Beveiligd Telefoontoestel (DBT)
- iv) - Data Communication Card (DCC)

The DTE equipment will handle the end-to-end communication facilities of VLOTATS and the DCE equipment the coupling functions to the ZODIAC network. To enable the DTE equipment to dial-up a connection over the ZODIAC network, both the DTE and DCE equipment will support an remote dial functionality based on the CCITT Recommendation V.25 bis [Ref. 1] and as modified by the following documentation:

- i) TNO-FEL Report FEL-A116, Definition Study into the Requirements of a Data Modem for the SYSCOM Network [Ref. 2]
- ii) TNO-FEL Report, Concept Functionele Specificaties van het ZODIAC Modem [Ref. 3].
- iii) DMKL/CIS Technical Specification No. SL-7025-2-125-035/1 for the Communication Gateway-Test Target [Ref. 4].
- iv) DMKL/CIS Technical Specification No. (To be published) for the Message Terminal Communicatie Kaart [Ref. 5].
- v) DMKL/CIS Technical Specification No. TS-7025-2-125-125 version 0.4 for the Digitale Interfaces (DIGIFC) [Ref. 6].

Together all these specifications specify the exact interface parameters that must be supported by the equipments when providing the auto-dialling facility based on CCITT Recommendation V.25 bis.

To enable the DMKL to confirm that the equipments have correctly implemented their respective interface parameters, TNO-FEL has been tasked to develop a V.25 bis Emulator. This V.25 bis

Emulator is capable of supporting all the defined interface parameters contained in the above referenced documentation. It can emulate the setting-up and closing down of connections in both the Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) modes of operation as defined in CCITT Recommendation V.25 bis. The V.25 bis Emulator will be used as an evaluation tool during the conformance testing of the equipments. This document contains the interface technical specification for the V.25 bis Emulator.

2 EMULATOR FUNCTIONAL SPECIFICATION

This chapter details which elements of the CCITT Recommendation V.25 bis interface protocols shall be supported by the V.25 bis Emulator when emulating either a DTE or DCE function. In both emulation modes, the V.25 bis Emulator shall operate in accordance with CCITT Recommendation V.25 bis 'Mode 1' mode of operation defined as follows:

In 'Mode 1' the DTE shall authorise the addressed call and/or answer using the CCITT Recommendation V.24 circuit 108/2, (DTR) and by means of instructions (i.e Commands and Indications) exchanged between the DTE and DCE on CCITT Recommendation V.24 circuits 103, (Transmitted Data) and 104, (Received Data).

As the V.25 bis Emulator is intended only to emulate the CCITT V.25 bis "signalling" phase, it shall not be responsible or provide facilities for the control and transfer of data after call establishment.

2.1 Data Terminal Equipment (DTE) Mode.

When emulating in the DTE mode the V.25 bis Emulator shall be responsible for the following:

- i) during call establishment
 - a) for ensuring that the DCE function is available for operation.
 - b) for providing the number to be dialled.
 - c) for abandoning the call if unsuccessfully completed.
- ii) after call establishment
 - a) for initiating a disconnect (i.e. 'On-hook') of the established call.

2.2 Data Circuit-Terminating Equipment (DCE) Mode.

When emulating in the DCE mode the V.25 bis Emulator shall be responsible for the following:

- i) during call establishment
 - a) for informing the DTE function that it is available for operation.
 - b) for informing the DTE function that an incoming call has been received.
 - c) for informing the DTE function that a call establishment has failed or been abandoned.
- ii) after call establishment
 - a) for informing the DTE function that the present call has been disconnected.

2.3 Interchange Circuits.

The V.25 bis Emulator shall support the following CCITT Recommendation V.24 100 series interchange circuits as shown in Table 2.3. The use of these interchange circuits shall be as described below and are only valid for the duration of the CCITT Recommendation V.25 bis call establishment and answering phases.

Table 2.3: 100 Series Interchange Circuits

Interchange Circuits		Direction	
Number	Name	From DCE	To DCE
103	Transmitted Data		X
104	Received Data	X	
106	Clear to Send	X	
107	Data Set Ready	X	
108/2	Data Terminal Ready		X
114	Tx Element Timing	X	
115	Rx Element Timing	X	

2.3.1 Circuit 103 - Transmitted Data

This circuit shall be used by the V.25 bis Emulator for the issuing and reception of 'Commands' when operating in the DTE and DCE mode, respectively.

2.3.2 Circuit 104 - Received Data

This circuit shall be used by the V.25 bis Emulator for the issuing and reception of 'Indications', in response to Commands, when operating in the DCE and DTE mode, respectively.

2.3.3 Circuit 106 - Clear to Send

When operating in the DCE mode, the V.25 bis Emulator shall set this circuit ON in response to the DTE setting circuit 108/2 ON.

When operating in the DCE mode, the V.25 bis Emulator shall set this circuit OFF:

- i) when emulating the completion of the call establishment phase.
- ii) when emulating the completion of the incoming call phase.
- iii) in response to the DTE aborting the call set-up, by setting circuit 108/2 OFF.
- iv) when emulating the DCE aborting the call set-up.

2.3.4 Circuit 107 - Data Set Ready

When operating in the DCE mode, the V.25 bis Emulator shall set this circuit ON when emulating that the data transfer phase can now be or has been entered.

When operating in the DCE mode, the V.25 bis Emulator shall set this circuit OFF:

- i) when emulating that the connection has been disconnected during the data transfer phase.
- ii) in response to a disconnect request (i.e. 'On-hook') by the DTE during the data transfer phase, by setting circuit 108/2 OFF.

2.3.5 Circuit 108/2 - Data Terminal Ready

When operating in the DTE mode, the V.25 bis Emulator shall set this circuit ON to indicate that it is ready to hold dialogue with the DCE, either to initiate a call establishment or to accept incoming calls

When operating in the DTE mode, the V.25 bis Emulator shall set this circuit OFF:

- i) to instruct the DCE to abort the call set-up.
- ii) to instruct the DCE to disconnect the connection.
- iii) to acknowledge that the DCE aborted the call set-up or connection.

2.3.6 Circuit 114/115 - Tx/Rx Element Timing

Although these circuits are not defined in CCITT Recommendation V.25 bis, they shall be provided by the V.25 bis Emulator when operating in the DCE mode as support timing to the synchronous character oriented and synchronous bit oriented transmission mode of operation.

2.4 Commands and Indications.

In support to the interchange circuits above during the call set-up phase, the V.25 bis Emulator shall support the following Commands (DTE to DCE) and Indications (DCE to DTE) as shown in Table 2.4. These Commands and Indications shall consist of a three upper-case International Alphabet No. 5, (IA5) character suffix accompanied with a set of parameters where necessary. These parameter sets shall also consist of a set upper-case IA5 characters and/or digits. The following describes the operation of these Commands and Indications and their associated parameters

2.4.1 Call Request with Number (CRN)

When operating in the DTE mode, the V.25 bis Emulator shall send this Command to instruct the DCE to initiate a call set-up. The Command shall consist of the suffix CRN followed by the parameter consisting of a string of digits that make up the number to be dialled. The maximum number of digits that can be sent with this Command shall be 32.

2.4.2 Disregard Incoming Call (DIC)

When operating in the DTE mode, the V.25 bis Emulator shall send this Command to instruct the DCE to bar all incoming calls until a CIC command is received. The Command shall consist of the suffix DIC with no associated parameter.

2.4.3 Connect Incoming Call (CIC)

When operating in the DTE mode, the V.25 bis Emulator shall send this Command to instruct the DCE to enable incoming calls, thus reversing any previously sent DIC command. The Command shall consist of the suffix CIC with no associated parameter.

Table 2.4: Commands and Indications

Commands/ Indications	IA5 Characters	Parameter Format	C/I
Call Request with Number	CRN	CRN XX...XX	C
Disregard Incoming Call	DIC	DIC	C
Connect Incoming Call	CIC	CIC	C
INcoming Call	INC	INC	I
Call Failure Indication	CFI	CFI XX	I
Call ConNecting	CNX	CNX XXYY	I
INValid	INV	INV	I
VALid	VAL	VAL	I

2.4.4 Incoming Call (INC)

When operating in the DCE mode, the V.25 bis Emulator shall send this Indication, unless barred from doing so by a previously sent DIC Command, to emulate that an incoming call is pending. The Indication shall consist of the suffix INC with no associated parameter.

2.4.5 Call Failure Indication (CFI)

When operating in the DCE mode, the V.25 bis Emulator shall send this Indication to emulate the reason for a call establishment failure. The Indication shall consist of the suffix CFI followed by one of the following parameters:

- i) ET - Engaged Tone: sent when called station is busy.
- ii) NT - Number Unobtainable: sent when the dialled number was unobtainable.
- iii) RT - Ring Tone: sent when the subscriber fails to answer within a specified time period.

- iv) AB - Abort Call: sent when the DCE aborted the call set-up.
- v) CB - Local DCE Busy: sent as an indication that Affiliation and Deaffiliation succeeded.

2.4.6 Call Connecting (CNX)

When operating in the DCE mode, the V.25 bis Emulator shall send this Indication to emulate the security level of the connection established. The Indication shall consist of the suffix CNX followed by the parameter sets XX and YY.

The parameter set XX shall be one of the following:

- i) NL - Non-secure Line: indicates that the connection is not secure.
- ii) SL - Secure Line: indicates that the connection is secure.
- iii) CR - Crypto: indicates that the connection is cryptographically secured.

The parameter set YY shall indicate the Mode of the connection and it shall consist of two digits in the range 00..99.

The CNX Indication and its associated parameters are optional to send, therefore the DCE shall emulate the following Indication combinations:

- i) < none > no Indication sent
- ii) CNX Indication with no associated parameters sent
- iii) CNX-XX Indication with only XX parameters sent
- iv) CNX-YY Indication with only YY parameters sent
- iv) CNX-XXYY Indication with both XX and YY parameters sent

2.4.7 Invalid (INV)

When operating in the DCE mode, the V.25 bis Emulator shall send this Indication to indicate that a Command was received whereby one of the following was detected:

- i) Parity or Frame Check Sum (FCS) error.
- ii) Syntax/Format error.
- iii) Non-executable Command.

The Indication shall consist of the suffix INV with no associated parameter.

2.4.8 Valid (VAL)

When operating in the DCE mode, the V.25 bis Emulator shall send this Indication to acknowledge the acceptance of the received Command. The Indication shall consist of the suffix VAL with no associated parameter.

2.5 Transmission Formats.

The V.25 bis Emulator shall support the following transmission formats when transmitting Commands and Indications:

- i) Asynchronous operation
- ii) Synchronous character oriented operation
- iii) Synchronous bit oriented operation.

2.5.1 Asynchronous Operation

The transmission format for asynchronous operation shall be as shown in Figure 2.5.1. In this mode of operation the character format shall be one Start element followed by an 8-bit data unit and one-unit Stop element. The 8-bit data unit "Message" shall consist of a 7-bit IA5 character in accordance with CCITT Recommendation T.50, together with an even Parity unit in accordance with CCITT Recommendation V.4. The end of the Message (i.e. Command/Indication + Parameters) shall be signified by the transmission of the character Carriage Return (CR). The CR may be optionally followed by the character Line Feed (LF). In this mode of operation the V.25 bis Emulator shall operate at 50, 75, 110, 150, 300, 600, 1200 and 2400 bits/second.

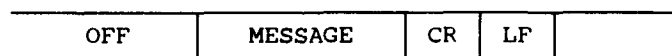


Fig. 2.5.1: Asynchronous Operation Transmission Format

2.5.2 Synchronous Character Oriented Operation

The transmission format for synchronous character oriented operation shall be in accordance with ISO 1745 and as shown in Figure 2.5.2. The Message shall consist of consecutive 8-bit data units which shall consist of a 7-bit IA5 character in accordance with CCITT Recommendation T.50, together with an odd Parity unit in accordance with CCITT Recommendation V.4. In this mode of operation the V.25 bis Emulator shall operate at 2400 and 9600 bits/second.

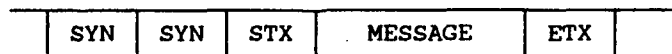


Fig. 2.5.2: Synchronous Character Oriented Operation Transmission Format

2.5.3 Synchronous Bit Oriented Operation

Transmission during the synchronous bit orientated mode of operation shall use an High-Level Data Link Control (HDLC) format as shown in Figure 2.5.3. The Message shall be contained in the information field of an Un-numbered Information (UI) frame transmitted with a global address and the Poll/Final (P/F) bit set to 1. Therefore the address and control field bits shall be as follows:

i) Address = 11111111

ii) Control = ^{LSB}11001000^{MSB}



Fig. 2.5.3: Synchronous Bit Oriented Operation Transmission Format

The Message shall consist of consecutive 8-bit data units (with zero insertion). The 8-bit data unit shall consist of a 7-bit IA5 character in accordance with CCITT Recommendation T.50, together with an eighth bit set to odd parity. Note no parity checking will be performed on the received Message characters. In this mode of operation the V.25 bis Emulator shall operate at 2400 and 9600 bits/second.

2.6 Command and Indication Exchange Protocols

The V.25 bis Emulator when operating in either the DTE or DCE mode of operation shall apply the following rules during the exchange of Commands and Indications:

- i) Every Command shall be followed by:
 - a) at least one Indication before a new Command shall be expected.
 - b) or by circuit 107 being set ON in the case of a successful call set-up.
- ii) Several Indications may be issued by the DCE, one after the other, either of the same nature or of a different nature.
- iii) The issuing by the DTE of a Command during the call request phase shall result in:
 - a) the previous and new Command being aborted with the Indication CFI-AB and circuit 106 being set to the OFF condition.
- iv) The issuing by the DTE of a Command in collision with an incoming call (i.e. INC Indication) shall result in:
 - a) a CRN Command being aborted and the incoming call shall proceed.

- b) a DIC Command being acknowledged and the incoming call shall proceed, but all subsequent incoming calls shall be disregarded.

3 OPERATION IN THE DTE MODE

3.1 General

This chapter details the operational characteristics of the V.25 bis Emulator when operating in the DTE mode as defined in para. 2.1. In this mode the DTE shall be capable of performing the following functions:

- i) the setting of circuit 108/2 (DTR) ON and OFF as defined in para. 2.3.5.
- ii) the initiation of a call set-up by issuing the CRN Command as defined in para. 2.4.1. When issuing this Command the V.25 bis Emulator shall be capable of emulating the following:
 - a) the issuing of a correct CRN Command whereby the number shall consist of upto 32 digits.
 - b) the issuing of an incorrect CRN Command whereby the number shall consist of more than 32 digits or the number includes an alpha character.
- iii) the issuing of the DIC and CIC Commands as defined in paragraphs 2.4.2 and 2.4.3 respectively.
- iv) the detection of the following Indications; INC, CFI, CNX, INV and VAL, as defined in paragraphs 2.4.4 to 2.4.8 respectively.
- v) the monitoring of circuits 106 and 107.

As well as the above, the V.25 bis Emulator in the DTE mode of operation shall be capable of performing the following additional functions:

- i) the issuing of the above Commands with a parity (asynchronous operation) or FCS (synchronous bit oriented operation) error.
- ii) the issuing of an unknown Command.

3.2 DTE Interface Procedures

When operating in the DTE mode of operation the V.25 bis Emulator shall be capable of supporting a number of test scenario's. These test scenario's shall be automatic or manually selectable and they shall be implementable during the two different CCITT Recommendation V.25 bis interface procedures namely:

- i) Call set-up.
- ii) Answering an incoming call.

The following paragraphs define the interface procedures and test scenario's for the V.25 bis Emulator when performing a call set-up or answering an incoming call in the DTE mode of

operation. The interface procedures have been divided into a number of "states". Within each state is defined the action and expected re-action necessary so as to progress to the following state. These interface procedure states have been represented in diagrammatical form as shown in Figure 3.2.

Note: In the following definitions the use of the characters -, /, and + when defining Indications are only used to distinguish the different possible associated parameters. They are not part of, nor are they present in the Indication itself.

3.2.1 DTE Call Set-up Procedure

- i) When the DTE is not ready to enter dialogue with the DCE or answer an incoming call, the DTE shall be in state 1, **DTE Not Ready**, with circuit 108/2 set to the OFF condition. In this state the DTE shall expect circuit 106 and 107 also to be set to the OFF condition.
- ii) To initiate the dialogue phase with the DCE, the DTE shall set circuit 108/2 ON and move to state 2, **DTE Ready**. If while in this state the DTE detects circuit 107 being set to the ON condition it shall move direct to state 7, **Data Transfer Ready**.
- iii) If while in state 2 the DTE detects circuit 106 being set to the ON condition, it shall move to state 3, **DTE-DCE Dialogue**. In this state the DTE shall be capable of issuing the following Commands:
 - a) DIC, CIC and/or CRN.or receiving the following Indications:
 - b) VAL, INV, INC and/or CNX-NL/SL/CR + 00..99.While in this state, it shall be possible for the DTE to issue a DIC or CIC Command, which shall be acknowledged by the DCE with a VAL or INV Indication, prior to the issuing of a CRN Command. It shall not be possible for the DTE to issue a DIC or CIC Command after having issued a CRN Command. If the DTE emulates the issuing of an incorrect DIC, CIC, CRN or unknown Command (see para. 3.1) then the DTE shall expect to receive the INV Indication and remain in state 3.
- iv) To initiate a call set-up the DTE shall issue a CRN Command as defined in para. 2.4.1, which shall be acknowledged by the DCE with a VAL or INV Indication. On receipt of the VAL Indication the DTE shall move to state 4, **Call Establishment**.
- v) While in state 4 the DTE shall be capable of receiving the following Indications:
 - a) CFI-NT/ET/RT/CB.
 - b) CFI-AB.
 - c) CNX-NL/SL/CR + 00..99.

In the event that one of the Indications listed in a) is received, the DTE shall return to state 3. If the Indication CFI-AB is received the DTE shall return to state 2, where it shall expect circuit 106 to be set to the OFF condition. The DTE shall remain in state 2 until circuit 106 is set to the ON condition. In the event that one of the Indications listed in c) is received and/or circuit 106 is set to the OFF condition, the DTE shall move to state 5, Call Established.

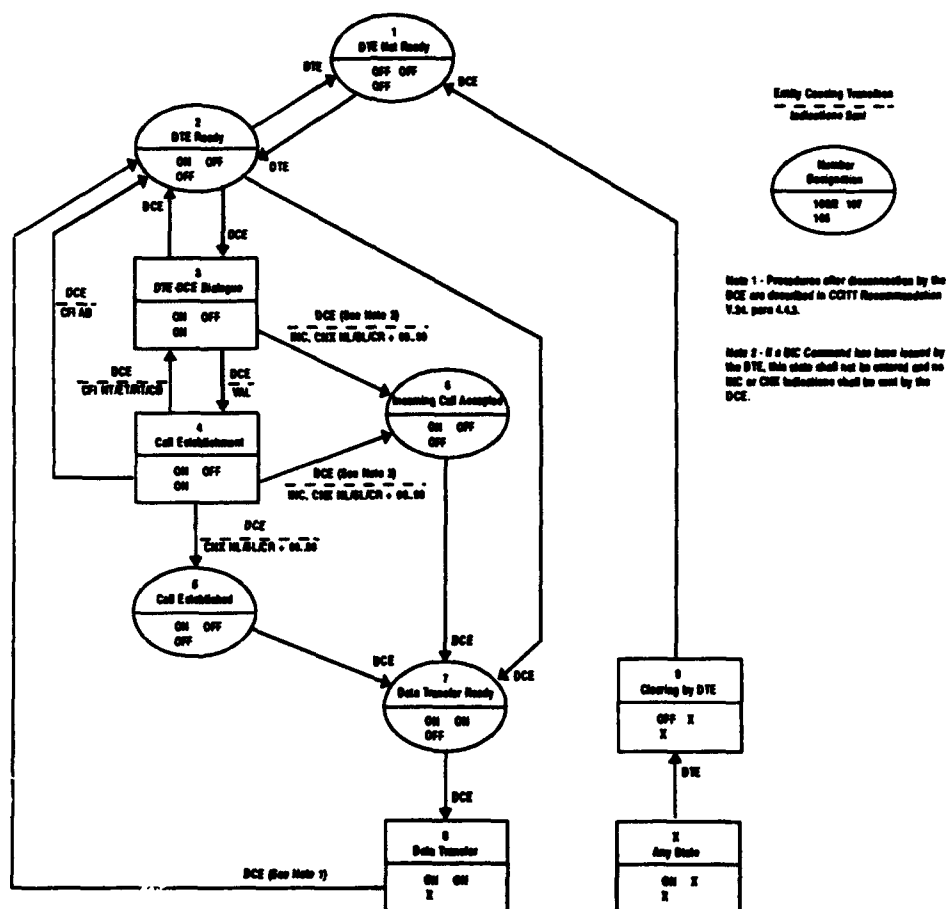


Fig. 3.2: V.25 bis Emulator Interface Procedures

- vi) If while in state 5 the DTE detects circuit 107 being set to the ON condition, it shall move to state 7, Data Transfer Ready. From this state the DTE can move to state 8, Data Transfer.
- vii) While in state 8 the DTE shall not perform any data transfer function, it will however monitor circuit 107. In the event that circuit 107 is set to the OFF condition the DTE in

response shall return to state 2, where it shall expect circuit 106 to be set to the OFF condition. It shall then return to state 1 by setting circuit 108/2 to the OFF condition. The DTE shall remain in this state for a minimum period of 500ms (See CCITT Recommendation V.24 para. 4.4.3) after which time it shall be capable of setting circuit 108/2 to the ON condition.

- viii) The DTE shall be capable of clearing the call set-up any time by setting circuit 108/2 to the OFF condition, state 9, **Clearing by DTE**. In the event of this occurring the DTE shall return to state 1, where it shall expect circuit 106 and 107 also to be set to the OFF condition.

3.2.2 DTE Incoming Call Procedure

- i) When the DTE is not ready to enter dialogue with the DCE or answer an incoming call, the DTE shall be in state 1, **DTE Not Ready**, with circuit 108/2 set to the OFF condition. In this state the DTE shall expect circuit 106 and 107 also to be set to the OFF condition.
- ii) To initiate the dialogue phase with the DCE, the DTE shall set circuit 108/2 ON and move to the state 2, **DTE Ready**. If while in this state the DTE detects circuit 107 being set to the ON condition it shall move direct to state 7, **Data Transfer Ready**.
- iii) If while in state 2 the DTE detects circuit 106 being set to the ON condition, it shall move to state 3, **DTE-DCE Dialogue**. In this state the DTE shall be capable of issuing the following Commands:

- a) CRN, DIC and/or CIC

or receiving the following Indications:

- b) VAL, INV, INC and/or CNX-NL/SL/CR + 00..99.

While in this state it shall be possible for the DTE to issue a DIC, CIC and/or CRN Command, which shall be acknowledged by the DCE with a VAL or INV Indication, prior to the receipt of an INC Indication. It shall not be possible for the DTE to issue a DIC, CIC or CRN Command after having received an INC Indication. If the DTE emulates the issuing of an incorrect DIC, CIC, CRN or Unknown Command (see para. 3.1) then the DTE shall expect to receive the INV Indication and it shall remain in state 3.

- iv) If while in state 3 a collision occurs between a DIC Command and an INC Indication the incoming call shall proceed (See vi. below). However, the DTE shall expect the DCE to disregard all subsequent incoming calls.
- v) In the event that a collision occurs, while in state 3 or 4, between a CRN Command and the detection of an incoming call (i.e. just prior to the seizure of the line), the incoming call shall proceed unless the DCE has been instructed to disregard incoming calls. In the event that

the DCE has been instructed to disregard incoming calls, the DTE shall expect the CRN Command to be executed as defined in para. 3.2.1. If no DIC Command had been issued by the DTE then the DTE shall expect the CRN Command to be aborted and the incoming call to proceed (See vi. below).

- vi) When an incoming call proceeds, either from state 3 or 4 (See iv. and v. above), the DTE shall expect to receive an INC Indication. Depending on the emulated network characteristics the DTE shall then be capable of receiving one of the CNX Indication options as defined in para. 2.4.6. As the CNX Indication is optional the DTE shall be capable of moving direct to state 6, **Incoming Call Accepted**, on detection of circuit 106 to be set to the OFF condition without the receipt of an CNX Indication.
- vii) If while in state 6 the DTE detects circuit 107 being set to the ON condition, it shall move to state 7, **Data Transfer Ready**. From this state the DTE can move to state 8, **Data Transfer**.
- viii) While in state 8 the DTE shall not perform any data transfer function, however it will monitor circuit 107. In the event that circuit 107 is set to the OFF condition, the DTE in response shall return to state 2, where it shall expect circuit 106 to be set to the OFF condition. It shall then return to state 1 by setting circuit 108/2 to the OFF condition. The DTE shall remain in this state for a minimum period of 500ms (See CCITT Recommendation V.24 para. 4.4.3) after which time it shall be capable of setting circuit 108/2 to the ON condition.
- ix) The DTE shall be capable of clearing the established call any time by setting circuit 108/2 to the OFF condition, state 9, **Clearing by DTE**. In the event of this occurring the DTE shall return to state 1, where it shall expect circuit 106 and 107 also to be set to the OFF condition.

4 OPERATION IN THE DCE MODE

4.1 General

This chapter details the operational characteristics of the V.25 bis Emulator when operating in the DCE mode as defined in para. 2.2. In this mode the DCE shall be capable of performing the following functions:

- i) the setting of circuit 106 (CTS) ON or OFF as defined in para. 2.3.3.
- ii) the setting of circuit 107 (DSR) ON or OFF as defined in para. 2.3.4.
- iii) the issuing of the following Indications; INC, CFI, CNX, INV and VAL, as defined in paragraphs 2.4.4 to 2.4.8 respectively.
- iv) the detection of the following Commands; CRN, DIC and CIC as defined in paragraphs 2.4.1 to 2.4.3 respectively.
- v) the monitoring of circuit 108/2.

As well as the above, the V.25 bis Emulator in the DCE mode of operation shall be capable of emulating the following network and subscriber characteristics:

- i) time-outs.
- ii) security.
- iii) availability.

The V.25 bis Emulator in the DCE mode shall not provide any facilities so as to interface to the network, nor shall it perform any network signalling protocols.

4.2 DCE Interface Procedures

When operating in the DCE mode of operation the V.25 bis Emulator shall be capable of supporting a number of test scenario's. These test scenario's shall be automatic or manually selectable and they shall be implementable during the emulation of the two different CCITT Recommendation V.25 bis interface procedures as described for the DTE mode of operation.

The following paragraphs define the interface procedures and test scenario's for the V.25 bis Emulator when emulating a call set-up or incoming call in the DCE mode of operation. Each of the interface procedures has been divided into a number of states defining the action and expected re-action necessary so as to progress to the following state. These interface procedure states have been represented in diagrammatical form as shown in Figure 3.2.

Note: In the following definitions the use of the characters -, /, and + when defining Indications are again used to distinguish the different possible associated parameters. They are not part of, nor are they present in the Indication itself.

4.2.1 DCE Call Set-up Procedure

- i) When the DTE is in state 1, **DTE Not Ready**, by having set circuit 108/2 to the OFF condition, the DCE shall set both circuit 106 and 107 to the OFF condition.
- ii) On detection of the DTE setting circuit 108/2 to the ON condition and thus entering state 2, **DTE Ready**, the DCE shall be capable of either:
 - a) setting circuit 107 to the ON condition where it shall move directly to state 7, **Data Transfer Ready**.
 - b) setting circuit 106 to the ON condition and moving to state 3, **DTE-DCE Dialogue**.In state 3, the DCE shall be capable of receiving the following Commands:
 - a) CRN, DIC and/or CIC.or issuing the following Indications:
 - b) VAL, INV, INC and/or CNX-NL/SL/CR + 00..99.
- iii) While in state 3 the DCE shall on receipt of a correctly issued CRN, DIC or CIC Command from the DTE issue a VAL Indication in response. In the event that the DCE receives an incorrect or unknown Command (See para. 3.1) it shall respond by issuing an INV Indication. The DCE shall expect to receive a DIC and/or CIC Commands prior to a CRN Command. On receipt of a CRN Command and having issued a VAL Indication the DCE shall move to state 4, **Call Establishment**.
- iv) While in state 4 the DCE shall be capable of issuing the following Indications:
 - a) CFI-NT/ET/RT/CB.
 - b) CFI-AB.
 - c) CNX-NL/SL/CR + 00..99.

In the event that one of the Indications listed in a) is issued, the DCE shall return to state 3. If the Indication CFI-AB is issued the DCE shall return to state 2 by setting circuit 106 to the OFF condition. After a variable interval of between 100 - 1000ms the DCE shall reset circuit 106 to the ON condition. In the event that one of the Indications listed in c) is issued and/or the DCE sets circuit 106 to the OFF condition it shall move to state 5, **Call Established**.

- v) If during state 4 a new Command (correct, incorrect or unknown) is received, the DCE shall abort the previous and new Command by issuing a CFI-AB Indication as well as setting circuit 106 to the OFF condition and returning to state 2. After a variable interval of between 100 - 1000ms the DCE shall reset circuit 106 to the ON condition and move to state 3.
- vi) While in state 5 the DCE shall be capable of setting circuit 107 to the ON condition so as to emulate the completion of the call set-up phase. On setting circuit 107 to the ON condition the DCE shall move to state 7, **Data Transfer Ready**. From this state the DCE can move to state 8, **Data Transfer**.
- vii) While in state 8 the DCE shall not perform any data transfer function. It shall be capable of setting circuit 107 to the OFF condition so as to emulate the termination of the call by the DCE. In the event that the DCE sets circuit 107 to the OFF condition it shall return to state 2 and set circuit 106 to the OFF condition. While in state 2 the DCE shall expect the DTE to set circuit 108/2 to the OFF condition and return to state 1. The DCE shall expect the DTE to remain in this state for a minimum period of 500ms (See CCITT Recommendation V.24 para. 4.4.3), after which time the DTE may set circuit 108/2 to the ON condition.

4.2.2 DCE Incoming Call Procedure

- i) When the DTE is in state 1, **DTE Not Ready**, by having set circuit 108/2 to the OFF condition, the DCE shall set both circuit 106 and 107 to the OFF condition.
- ii) On detection of the DTE setting circuit 108/2 to the ON condition and thus entering state 2, **DTE Ready**, the DCE shall be capable of either:
 - a) setting circuit 107 to the ON condition where it shall move directly to state 7, **Data Transfer Ready**.
 - b) setting circuit 106 to the ON condition and moving to state 3, **DTE-DCE Dialogue**.

In state 3, the DCE shall be capable of receiving the following Commands:

- a) CRN, DIC and/or CIC.

or issuing the following Indications:

- b) VAL, INV, INC and/or CNX-NL/SL/CR + 00..99.

- iii) While in state 3 the DCE shall on receipt of a correctly issued CRN, DIC or CIC Command from the DTE issue a VAL Indication in response. In the event that the DCE receives an incorrect or unknown Command (See para. 3.1) it shall respond by issuing an INV Indication. The DCE shall expect to receive a DIC and/or CIC Commands prior to a CRN Command.

- iv) If while in state 3 the DCE detects an incoming call it shall issue an INC Indication if no previous DIC Command had been received. If a previous DIC Command had been received, on detection of the incoming call, the DCE shall not issue an INC Indication and it shall emulate the termination of the incoming call at the network side and remain in state 3.
- v) If while in state 3 and in the event that a collision occurs between a DIC Command and an INC Indication the DCE shall proceed with the incoming call (See vi. below). The DCE shall disregard all subsequent incoming calls.
- vi) In the event that a collision occurs, while on state 3 or 4, between a CRN Command and the detection of an incoming call (i.e. just prior to the seizure of the line), the incoming call shall proceed unless the DCE has been instructed to disregard incoming calls. If the DCE has been instructed to disregard incoming calls it shall emulate the termination of the incoming call at the network side and then proceed with the CRN Command as defined in para. 4.2.1. If no DIC Command has been received by the DCE it shall abort the CRN Command and proceed with the incoming call (See vii. below).
- vii) When an incoming call proceeds (See v. and vi. above) the DCE shall issue an INC Indication. Depending on the emulated network characteristics the DCE shall then be capable of issuing one of the CNX Indication options as defined in para. 2.4.6. As the CNX Indication is optional the DCE shall be capable of moving direct to state 6, **Incoming Call Accepted**, by setting circuit 106 to be set to the OFF condition without issuing an CNX Indication.
- viii) While in state 6 the DCE shall be capable of setting circuit 107 to the ON condition so as to emulate the completion of the incoming call phase. On setting circuit 107 to the ON condition the DCE shall move to state 7, **Data Transfer Ready**. From this state the DCE can move to state 8, **Data Transfer**.
- ix) While in state 8 the DCE shall not perform any data transfer function. It shall be capable of setting circuit 107 to the OFF condition so as to emulate the termination of the call by the DCE. In the event that the DCE sets circuit 107 to the OFF condition it shall return to state 2 and set circuit 106 to the OFF condition. While in state 2 the DCE shall expect the DTE to set circuit 108/2 to the OFF condition and return to state 1. The DCE shall expect the DTE to remain in this state for a minimum period of 500ms (See CCITT Recommendation V.24 para. 4.4.3), after which time the DTE may set circuit 108/2 to the ON condition.

5 V.25 BIS EMULATOR IMPLEMENTATION

5.1 General

The V.25 bis Emulator shall be implemented in both hardware and software. The hardware modules shall be mounted on a "Full Size" extender card suitable for insertion into IBM compatible Personal Computer's (PC). The complete V.25 bis Emulator (hardware and software) shall be housed in a LAPTOP PC.

5.2 Man-machine Interface

The man-machine interface shall consist of a hierarchical window type "Menu Driven Display" from which the operator will be able to select, via the keyboard, the V.25 bis Emulator functionality required. In the event that the operator selects a function that is not implementable during a particular test procedure (e.g. issuing a DIC Command after a CRN Command, issuing a CFI Indication during an Incoming Call procedure) then that function will not be executed and the operator will receive an "Error Statement" on the PC screen.

At the highest level of the Menu Driven Display the operator will be able to select which mode the V.25 bis Emulator shall operate in, DTE or DCE, and the particular transmission format, asynchronous or synchronous and baud rate required. At the lower levels the operator will be able to select manually or automatically the particular CCITT Recommendation V.25 bis function required as follows:

In the case when the V.25 bis Emulator is operating in the DTE mode, the operator will be able to perform the following:

- (i) Manually set circuit 108/2 (DTR) ON or OFF via the keyboard.
- (ii) Manually type a Command via the keyboard.
- (iii) Store and/or select CRN Commands.
- (iv) Manually send pre-defined DIC, CIC and/or selected CRN Commands.

In the case when the V.25 bis Emulator is operating in the DCE mode, the operator will be able to perform the following:

- (i) Manually set circuits 106 (CTS) and 107 (DSR) ON or OFF via the keyboard.
- (ii) Manually type Indications via the keyboard.
- (iii) Manually send pre-defined INV, VAL, INC, and/or selectable CFI and CNX Indications.
- (iv) Select the DCE to operate in an automatic mode, whereby the DCE will emulate responses to DTE actions in "real-time".

As well as the above, in both modes of operation, the operator will receive on the V.25 bis Emulator screen in the form of a "History-Log" the following:

- (i) Indication status (ON or OFF) of the implemented 100 series lines (see para. 2.3).
- (ii) Display of all Commands and Indications issued/received whether they were expected or not.

In addition to the error statement displayed when the operator chooses a function at the incorrect point in a particular procedure, the operator will also receive an error statement in the event that he/she makes an incorrect entry/choice via the keyboard.

REFERENCES

- [1] : CCITT Blue Book Volume VIII - Fascicle VIII.3
Data Communication over the Telephone Network,
Recommendations of the V series,
IXTH Plenary Assembly, 14-25 November 1988.

- [2] : TNO-FEL Report No. FEL-90-A116
Definition Study into the Requirements of a Data Modem
for the SYSCOM Network,
Author P.P. Copeland, dated May 1990.

- [3] : TNO-FEL Report - To be Published
Functionele Specificaties van de ZODIAC Modem
Author R. in't Velt, 'Concept' - dated October 1991.

- [4] : DMKL/CIS Technical Specification No. SL-7025-2-125-035/1
Communication Gateway - Test Target CGW-TT,
Published 18 February 1993.

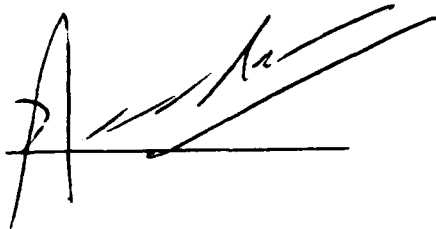
- [5] : DMKL/CIS Technical Specification No.
PC Communicatie Kaart,
To be Published.

- [6] : DMKL/CIS Technical Specification No. TS-7025-2-125-125 version 0.4
Digitale Interfaces (DIGIFC),
Published 29 March 1993.

LIST OF ABBREVIATIONS

CCITT	Consultative Committee for International Telegraph and Telephone
CFI	Call Failure Indication
CIC	Connect Incoming Call
CNX	Call Connecting
CR	Carriage Return
CRN	Call Request with Number
CTS	Clear to Send
DBT	Digitaal Beveiligd Telefoonstelsel
DCC	Data Communications Card
DCE	Data Circuit-Terminating Equipment
DIC	Disregard Incoming Call
DIGIFC	Digitale Interfaces
DMKL/CIS	Directie Materieel Koninklijke Landmacht/Communicatie en Informatie Systemen
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
ETX	End of Text
FCS	Frame Check Sequence
HDLC	High-Level Data Link Control
IA5	International Alphabet No.5
INC	Incoming Call
INV	Invalid
ISO	International Standards Organisation
LF	Line Feed
LSB	Least Significant Bit
ms	milli-second
MSB	Most Significant Bit
MTCK	Message Terminal Communicatie Kaart
PC	Personal Computer
P/F	Poll/Final
RNLA	Royal Netherlands Army
Rx	Receive
STX	Start of Text

SYN	Sync
SYSCOM	System Control and Management
Tx	Transmit
UI	Un-numbered Information
VAL	Valid
VLOTATS	Verlenging Life of Type Automatisch Telegrafic Systeem
ZODIAC	Zone Digitaal Automatisch Cryptobeveiligd

A handwritten signature in black ink, consisting of a large capital 'A' followed by a series of diagonal strokes, positioned above a horizontal line.

P.A.C.M. Meulemans
(Head of Telecommunications
and Information Security Group)

A handwritten signature in black ink, featuring a stylized 'P' and 'C' with multiple loops, positioned above a horizontal line.

P.P. Copeland
(Author)

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